Morphological and Histological Changes in Placentae of Hypertensive Women.

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Abstract:

Objective: To determine the changes in placentae in pregnant ladies suffering from pregnancy induced Hypertension.

Research Design: A cross sectional study

Place and duration: Sampling was done of the patients from the OPD's of Taluka hospital Hala and basic health unit Hala old, with collaboration of department of Anatomy, Baqai Medical University, Karachi, from june-2011-Dec- 2011

Material and Methods: Placentae were preserved in 10% formalin of Merck Company and studied macroscopically as well as microscopically. These features include shape, size, and site of attachment of umbilical cord, central thickness and diameter (in centimeter, diameters) and weights (in grams) of fully developed placentae. Microscopic feature will include infarction, placental haemorrhage, villous edema, hyper vascularity and increase production of syncytial epithelial knots.

Results: Central thickness (Mean ± S.D ± SEM) of hypertensive placenta 2.2 ± 0.58 ± 0.11 were significantly less ($p<0.01$) as compared to normal placenta 3.0 ± 0.03 ± 0.01. Hypertensive placenta diameter 19.5 ± 5.10 ± 0.93), weight 524.4 ± 154.7 ± 28.4.

Conclusion: Eclampsia causes significant morphological changes in placenta that affects fetal and maternal wellbeing. This study is helpful for those who are concerned for mother and child health.

Keywords: Placentae, Eclampsia, Macroscopy, Microscopically.

Introduction:

The placenta is a complex foetal organ that fulfills pleiotropic roles during foetal growth. It separates the maternal and foetal circulation, with which it is in contact through different surfaces, i.e., syncytiotrophoblast and endothelium. Because of this unique position, the placenta is exposed to the regulatory influence of hormones, cytokines, growth factors, and substrates present in both circulations and, hence, may be affected by changes in any of these. In turn, it can produce molecules that will affect mother and foetus[1].

Preeclampsia develops after a partial disorder in the process of placental formation, perhaps due to a deficiency of the trophoblast invasion by its spiral arteries and acute aterosis in its miometrial segments. It has not been reported if these changes also appear in placentas of women with gestational hypertension without proteinuria. Most frequent changes in all groups were: sincitial hyperplasia and fibrin deposits around the villi. There was correlation between histopathological changes and blood pressure ($r= 0.27$, $p <0.01$).There are more histopathological changes in placentas of women with hypertensive disease; number of histopathological changes is correlated with the severity of hypertension[2].

Pregnancy complicated by hypertension is commonly associated with placental insufficiency, thereby resulting in foetal growth retardation. Furthermore, reduced utero -placental blood flow has been recognized in cases of severe pre-eclampsia with hypertension. Thus, it must be assumed that histological as well as ultra structural findings in hypertensive placentas are due to the occlusion or narrowing of the uteroplacental vasculature as well as placental ischemia. Microscopically, these placental changes include infarcts, increased syncytial knots, hypovascularity of the villi, cytotrophoblastic proliferation, thickening of the trophoblastic basement membrane, obliterative enlarged endothelial cells in the foetal capillaries and atherosis of the spiral arteries in the placental bed. In addition, ultrastructural features are characterized by a decreased number of syncytial microvilli, proliferation of cytotrophoblastic cells, focal syncytial necrosis, thickening of trophoblastic basement membrane and narrowing of the foetal capillaries, as a number of studies have demonstrated. These placental abnormalities can be seen not only in human toxemia, but also in animals with experimentally induced toxemia or with spontaneous toxemia[3].

There is association lower placentary weight and volume, higher ratio of macro and microscopic infarction, clots, and atherosis changes to placentae of gestations

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occurring with hypertensive syndrome[4].

The initiating event in pre-eclampsia has been postulated to be reduced uteroplacental perfusion as a result of abnormal cytotrophoblast invasion of spiral arterioles. Placental ischemia is thought to lead to widespread activation/dysfunction of the maternal vascular endothelium that results in enhanced formation of endothelin and thromboxane, increased vascular sensitivity to angiotensin II, and decreased formation of vasodilators such as NO and prostacyclin. These endothelial abnormalities, in turn, cause hypertension by impairing renal-pressure natriuresis and increasing total peripheral resistance. Results from ongoing basic and clinical studies, however, should provide new and important information regarding the physiological mechanisms responsible for the elevation in arterial pressure in women with pre-eclampsia. This failure of trophoblast invasion in pre-eclampsia results in a reduction in uteroplacental perfusion, with the placenta becoming increasingly ischemic as gestation progresses[5.] Preeclampsia (PE) is a hypertensive disorder, which develops in late pregnancy and is usually associated with placental hypoxia and dysfunction, Pre-eclampsia (PE), which affects approximately 5-10% of all pregnant women, is one of the most common pregnancy-associated disorders. Hypertension with arteriolar vasoconstriction is its major clinical manifestation, which causes a reduction in uteroplacental blood flow, thus leading to placental hypoxia, as well as foetal growth retardation. It has been recognized that oxygen tension regulates a set of several placental genes that are critical to the proliferation and differentiation of cytotrophoblasts, which is proposed to contribute to the pathogenesis of PE.[6] In addition, placentas from women with pre-eclampsia display an increased frequency of placental infarcts and altered morphology evidenced by abnormal cytotrophoblast proliferation and increased formation of syncytial knots. Further empirical evidence for a key role of the placenta in the etiology of pre-eclampsia is

the generally rapid recovery that patients experience following delivery[7].

Preeclampsia is a major contributor to the maternal and neonatal mortality and morbidity[8]. It is the 2nd largest cause of maternal mortality worldwide and affects 5% to 7% of pregnant women worldwide[1].

Aims and Objective:

Present study aims to determine the changes in placentae in pregnant ladies suffering from pregnancy induced hypertension and gestational diabetic mellitus so as help the obstetrician for management of these problems during gestational period.

Material and Methods:

Research Design: A cross sectional study

Data Collection Procedures:

This study was carried at the department of gynae and obs Taluka hospital Hala, and Basic health unit Hala old cases were examined and identified for hypertension during pregnancy for the parameters mentioned successively. All the samples from these hospitals were collected personally as the patient came to the OPD'S and some of them were selected from the patients already admitted to the hospital for prenatal care. With the help of the hospital staff the placentae were collected in formalin containing plastic jars from labor room and operation theaters and weighed and labeled.

The samples divided into two groups

Group A:

This group comprises of 30 placentas from pregnancies, which will not be suffering from any disease, and will be served as control.

Group B:

This group comprises of 30 full term placentae from mothers suffering from hypertension.

In this study 90 full term placenta will be taken and divided into three groups of equal in number. The duration of this study was one year. All subjects in this study are mothers of any age. There are no racial, cultural or environmental differences among the subjects.

Ethical Consideration:

The written informed consent was taken from the patients, consultant and hospital administration of Taluka Hospital Hala and Basic Health Unit Hala old.

Inclusion and Exclusion Criteria:

For this study only mature placenta were taken, Premature and Post mature placenta were not considered in this study.

- Also hypertensive placentae were taken without any other complications.
- These placentae were preserved in 10% formalin after half hour after the delivery.

Sampling Technique:

Sampling was done of the patients from the OPD's of Taluka hospital Hala and basic health unit Hala old.

Methodology:

Placentae were preserved in 10% formalin of Merck Company and studied macroscopically as well as microscopically. The Gross features of placentae were noted and compared with normal placentae. These features include shape, size, and site of attachment of umbilical cord, central thickness (in centimeter, diameters) and weights (in grams) of fully developed placentae. Microscopic feature will include infarction, placental hemorrhage, villous edema, hyper vascularity and increase production of syncytial epithelial knots. Process of Embedding and sectioning was done according to the procedure given below and slides were stained with Hemotoxylin and Eosin dye of Merck Company and examined under light microscope using power lens of 10 and 40. Binocular light microscope of Olympus Germany Company was used in this study.

Data Management:

The data were obtained on basis of history, examination and investigation. It was then performed on SPSS-11.0 work sheet and conclusion was developed before application of different statistical tests. After that Clearing of

data was done, tests were applied and results were calculated.

Statistical Data:

The data feeding and analysis was on computer package SPSS (Statistical Packages of Social Sciences) version 11.0. Clinical characteristics will be summarized in terms of frequencies and percentages for qualitative variables (shape, size of attachment of umbilical cord, hemorrhage, infarction, villous edema, hypervascularity and syncytial epithelial knots of placenta) mean S.D. for quantitative variables (central thickness, diameter and weight) of placenta. Statistical comparison was performed by analysis of variance (ANOVA) with tukey test with multiple comparisons for quantitative and chi-square test/fisher exact test for qualitative variables. In all statistical analysis only p-value <0.05 will be considered significant.

Table 1

	Group A		Group B		A vs. B P-value
	Normal placenta (n=30)		Hypertensive placenta (n=30)		
	No.	%	No.	%	
Discoid	30	100.0	4	13.3**	0.001
Small discoid	-		19	63.3	-
Star discoid	-		7	23.3	0.765
Bilobed discoid	-		-		-
Acentric	30	100.0	15	50.0	0.063
Marginal	-		15	50.0	0.063
Hemorrhage	-		16	53.3	0.795
Infarction	-		16	53.3	0.602
Villous edema	-		18	60.0	0.273
Decreased	-		16	53.3**	0.007
Increased	-		9	30.0	0.113
No	30	100.0	5	16.7	0.222
Syncytial Epithelial knots	-		20	66.7**	0.004

Table 2

	Group A	Group B	P-value
	Normal placenta (n=30)	Hypertensive placenta (n=30)	
	Mean ± S.D ± SEM	Mean ± S.D ± SEM	
Central thickness (cm)	3.0 ± 0.03 ± 0.01	2.2 ± 0.58 ± 0.11**	0.001
Diameter (cm)	21.1 ± 3.37 ± 0.62	19.5 ± 5.10 ± 0.93	0.534
Weight (gm)	557.8 ± 33.85 ± 6.18	524.4 ± 154.7 ± 28.24	0.948

Results:

In table-1 showed total 60 placentae, 30 from normal, 30 from hypertensive. The study showed that shape discoid were significantly less 4(13.3%) in hypertensive as compared normal placenta ($p<0.01$). In hypertensive placenta 15(50%) were central attachment of umbilical cord, normal 30 (100%). Out of 30 cases of hypertensive placenta, 20 (66.7%) showed increased syncytial epithelial knots as compared to normal $p<0.01$. In table -2 central thickness (Mean ± S.D ± SEM) of hypertensive placenta 2.2 ± 0.58 ± 0.11 were significantly less ($p<0.01$) as compared to normal placenta 3.0 ± 0.03 ± 0.01. Hypertensive placenta diameter 19.5 ± 5.10 ± 0.93), weight 524.4 ± 154.7 ± 28.4.

Discussion:

Total 60 placentae, 30 from normal, 30 from hypertensive were included in this study and the morphological changes noted. In table-1 showed total 60 placentae, 30 from normal, 30 from hypertensive. The study showed that shape discoid were significantly less 4(13.3%) in hypertensive as compared normal placenta ($p<0.01$). In hypertensive placenta 15(50%) were central attachment of umbilical cord, normal 30 (100%). Out of 30 cases of hypertensive placenta, 20 (66.7%) showed increased syncytial epithelial knots as compared to normal $p<0.01$. In table -2 central thickness (Mean ± S.D ± SEM) of hypertensive placenta 2.2 ± 0.58 ± 0.11 were significantly less ($p<0.01$) as compared to normal placenta 3.0 ± 0.03 ± 0.01. Hypertensive placenta diameter 19.5 ± 5.10 ± 0.93), weight 524.4 ± 154.7 ± 28.4.

This study matches with the study of (kovo M et al., 2010)[8] Pregnancy-induced hypertension/preeclampsia (PIH) and foetal growth restriction (FGR) share a common placental origin Maternal vascular lesions were more common in the PIH group and combined group

(61% and 59%, respectively), compared with the FGR group (16.2%; P < .001), and villous lesions were more common in the combined group, compared with the FGR and PIH groups (79.5%, 53.5%, and 46.9%, respectively; P = .004). Foetal villous changes were observed in 16.2% in the FGR group, compared with 3.1% in the PIH group (P = .03), and chronic villitis was 15.2% in the FGR group vs 1.6% in the PIH group (P = .004).

Present study correlates with the study of (Ananth CV et al., 2007)[1] the increased risk of placental ischemic disease, specifically in pregnancy-induced hypertension (PIH) and foetal growth restriction (FGR). In late gestation, placental blood flow was significantly reduced in the moderate hypertension group, without accompanying changes in foetal or placental weight or placental efficiency. In contrast, mild hypertension resulted in an increase in placental efficiency, without significant changes in placental blood flow. These findings suggest that mild and moderate hypertension may alter placental delivery of nutrients via differing mechanisms dependent upon the severity of the hypertension.

Present study matches with study of (Kent AL et al., 2009)[9] Placental vascular changes associated with maternal disease state may affect foetal vascular development. There is evidence suggesting that being born prematurely is associated with a higher blood pressure (BP) in later life. Those born between 32-41 weeks gestation with placental pathology associated with altered uteroplacental perfusion had a higher systolic BP (P = 0.005). Maternal- or pregnancy-associated disease states appear to influence BP in the early neonatal period. Clinical significance of these statistically elevated BP in the early neonatal period is unknown.

Our study matched with the study of (Koech A et al., 2008) [10] Pregnancy Induced Hypertension (PIH) is associated with placental morphological changes, alterations in the blood flow patterns in the umbilical vessels and adverse foetal and maternal outcome. Studies have demonstrated changes in the structure of the umbilical vessels but these have not been described across the length of the cord or correlated with the severity of disease. The structure of the umbilical vessels changes from the placental end to the foetal end. The umbilical vein in PIH had a greater wall thickness and a smaller luminal area than in the controls. The vein's wall-luminal ratio increased from the placental to the foetal end.

We noted same as (Kurdkar G et al., 2007) [11] Variety of changes in placental villi is known to occur in Pregnancy Induced Hypertension. Villous changes such as edema and villous paucity noted in 18 placentae out of 30 having pregnancy induced hypertension. That is also one of the observations of Kurdar who found striking villious changes like edema, cytotrophoblastic proliferation, paucity of vasculosyncytial membrane, trophoblastic basement membrane thickening and fibrinoid necrosis of villi. The changes were directly proportional to the severity of disease and perinatal outcome was worse with advancing grades of PIH.

Conclusion:

Hypertension causes significant morphological changes in placenta that affects fetal and maternal wellbeing. This study is helpful for those who are concerned for mother and child health.

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